

## SERDP Addresses Critical Issue of UXO Detection at Defense Sites

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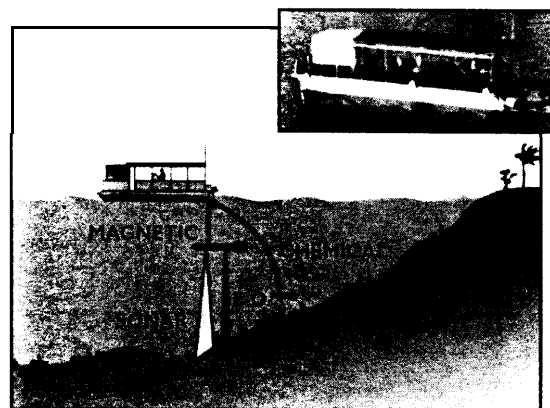
The location, identification, and remediation of unexploded ordnance (UXO) represents an enormous challenge to the effective cleanup of many DoD sites, primarily on land but also at sea. It is estimated that the DoD has over **6,000,000** acres of UXO contaminated land (not including the Air Force), and at least 50 sites at sea, with approximately 5,000,000 more acres on Department of Interior land. These lands represent a full range of terrains, vegetation content, soil types, and geophysical characteristics.

On land sites, the standard methodology for detection of UXO involves laborious ground surveys over potentially contaminated areas, typically with some form of metal detector. Probable locations are marked, and highly trained personnel are then required to remove each piece of ordnance that is identified. Typical times for surveys and UXO clearance range from less than one acre to a few acres per day. This methodology is too slow and impractical to meet the required timeline for UXO cleanup on DoD lands. Likewise, detection of UXO in underwater locations typically involves imprecise mine-sweeper technology, which is often incapable of distinguishing between partially buried ordnance and clutter. Furthermore, available underwater methodologies cannot detect totally buried UXO, which is a severe problem at aged sites where sediments have often covered much of the UXO.

SERDP has initiated a comprehensive program to address some of these critical UXO detection issues. SERDP is currently supporting the development of a Mobile Underwater Debris Survey System (MUDSS). A successful MUDSS demonstration in August 1995 proved the utility of a simple, trailerable, low-maintenance, catamaran-based system capable of finding and mapping the locations of ordnance ranging from small shells to large

bombs in water depths from four to forty feet (see figure). The system can also detect partially and totally buried ordnance covered with up to several feet of silt. Additional MUDSS developments with accompanying proof of concept are underway, including enhanced data fusion and visualization demonstrations, additional field trials, and development and integration of a chemical sensor.

Regarding land-based UXO contamination, MIT's Lincoln Laboratory recently completed a SERDP supported UXO detection feasibility study. This work comprehensively evaluated the scientific and technical state-of-the-art for UXO detection and identification and presented an integrated research and development (6.1 through 6.3) strategy to meet identified DoD requirements. SERDP recently issued a "Statement of Need" seeking innovative detection technologies, as recommended in the feasibility study. SERDP also anticipates supporting a data fusion study for UXO multi-sensing systems beginning in the near future, as recommended in the Lincoln Laboratory feasibility study. For more information, contact Dr. Femi Ayorinde, SERDP Cleanup Program Manager, at (703) 696-2118.



System concept of **MUDSS**



### Inside this Issue

- ♦ SERDP Success Stories, pgs. 2-3
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## SERDP Success Stories

As SERDP matures, it is providing a rapidly increasing number of outstanding technical advances. These developments are highly important and relevant to the Department of Defense, the Department of Energy, the Environmental Protection Agency, and the scientific community at large.

### New Aircraft Paint Strippers, Cleaners, and Coatings Reduce VOC and HAP Emissions

The DoD specifies an assortment of specialty cleaners, paint strippers, and coatings for aircraft depot operations. SERDP is supporting significant efforts to reduce volatile organic compound (VOC) and hazardous air pollutant (HAP) emissions from depot operations by developing non-VOC materials for cleaning/stripping, as well as non-toxic coatings. After successful evaluation, these materials become the basis for new or revised Military Specifications, which introduce these new materials at all DoD depots. Successful evaluation of non-VOC turbine engine cleaners, tank-type paint strippers, aircraft exterior cleaners, wheel-well degreasers, and non-toxic inhibitors has already resulted in the revision of eight Military Specifications. For more information, contact Mr. Stephen Spadafora at (301) 342-8007, Naval Air Warfare Center, Aircraft Division, Patuxent River, MD.

### SERDP Supports

#### Improved Biotreatment in Cold Regions Using Enhanced Rhizosphere Technology

With SERDP support, researchers from the U.S. Army Cold Regions Research

and Engineering Laboratory, the U.S. Army Water-ways Experiment Station, the University of Arkansas, the University of Vermont, and the University of Alaska-Fairbanks have successfully demonstrated enhanced Rhizosphere biotreatment for heavy petroleum compounds such as pristane, phytane, diesel fuel, and crude oils in the laboratory with corroborating field results at Ft. Wainwright, AK. Their work exploits the enhanced microbial activity in the Rhizosphere (the area of soil adjacent to plant roots) by reducing limitations that inhibit favorable microbial and enzyme activity (see figure). Enhanced Rhizosphere biotreatment has tremendous potential for low-cost soil treatment. Cost savings using Rhizosphere enhanced biotreatment, when compared to conventional remediation techniques in similar environments, can be significant. In fact, conservative estimates predict a 10-fold reduction in cost. For more information, contact Dr. Charles M. Reynolds at (603) 646-4394, U.S. Army Cold Regions Research and Engineering Laboratory, Hanover, NH.

### Water Injection Reduces

#### NO<sub>x</sub> Emissions from Gas Turbines

Preliminary tests supported by SERDP have shown that carefully controlled fresh water injection into either the bellmouth or the combustor of marine gas turbine engines reduces NO<sub>x</sub> emissions and increases output power. Both approaches achieve a reduction in NO<sub>x</sub> sufficient to meet the proposed requirements of the California Air Quality Control Board; but bellmouth injection requires three times as much water. Therefore, for marine applications with limited fresh water available, the preferred approach is to inject water into the combustor. However, water injection into the bellmouth has gained the attention of the California

SERDP Program Office  
901 N. Stuart Street  
Suite 303  
Arlington, Virginia 22203  
(703) 696-2117  
(703) 690-2114 Fax  
DSN 426-2117

SERDP Site Reference (Internet):  
<http://www.wes.army.mil/serdp/home.html>

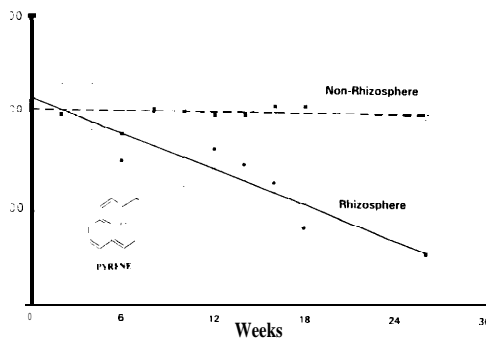
Dr. John Harrison  
SERDP Executive Director  
Mr. Gordon Wood  
SERDP Deputy Director  
Mr. Carl Adema  
Program Manager for  
Compliance and Pollution Prevention  
Dr. Femi Avorinde  
Program Manager for  
Cleanup and Conservation  
Ms. Brenda Batch  
Administrative Officer  
Ms. Amy Levine  
Executive Assistant  
Mr. M. Blake Henke  
Sr. Editor/Writer

We are always looking for articles and information... contact Blake Henke at the SERDP Support Office, 8000 Westpark Drive, Suite 400, McLean, Virginia 22102, Phone (703) 506-1400 x546 or Fax (703) 506-4646. This newsletter was written and published by LABAT-ANDERSON, Inc. under contract DACA39-95-D-O023.

Energy Commission (CEC) since bellmouth injection produces a substantially larger increase in power than combustor injection. The CEC, the Navy, and equipment manufacturers are discussing further collaborative research opportunities. For more information, contact Dr. Herman Urbach at (410) 293-2864, Naval Surface Warfare Center, Carderock Division, Annapolis, MD.

### SERDP Provides

Methodology to Assess Impacts of Military Smokes and Obscurants on TES  
The U.S. Army routinely conducts realistic training and testing exercises that fully simulate battlefield conditions in order to



Rhizosphere Enhancement of Pyrene Degradation

**Symposium  
Announcement**

# AGENDA

## Improving Mission Readiness Through Environmental Research

**1995's participants  
sing high praise . . .**

*"Very well organized*

*executed symposium . . .*

*End product was outstanding.*

*Looking forward to second*

*annual symposium."*

— Dr. Shun C. Ling  
U.S. Navy

*"Brilliant in presentation;  
content was outstanding.*

*Everyone with whom I spoke*

*was enthusiastic and*

*knowledgeable."*

— L. . Doris A. Anders  
Systematic Management Sources, Inc.

### Wednesday, November 20, 1996—Afternoon Session

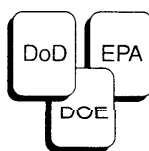
- Plenary sessions
- Technical sessions on Cleanup and Compliance
- Exhibits open/No-host reception in exhibit area following technical sessions

### Thursday, November 21, 1996—Full-day Session

- Technical sessions on Global Environmental Change, Cleanup, and Compliance
- Luncheon—Keynote address
- Technical sessions on Cleanup and Pollution Prevention
- Exhibits open

### Friday, November 22, 1996—Morning Session

- Technical sessions on Pollution Prevention, Conservation, and Energy Conservation/Renewable Resources
- Exhibits open during buffet lunch



# SERDP

Strategic Environmental Research  
and Development Program

Improving Mission Readiness Through  
Environmental Research

Announcing  
**2nd Annual**

# SERDP SYMPOSIUM

November 20-22, 1996

**Improving Mission Readiness Through Environmental Research**



Cleanup



Compliance



Conservation



Pollution Prevention



Global Environmental Change



Energy Conservation/  
Renewable Resources

## Location

Vienna, Virginia (near Washington D.C. and Dunes Airport)

Sheraton Premiere at Tysons Corner

## Who should attend

Policy makers, technical specialists, researchers, and managers of environmental programs in federal and state governments, academia, and the private sector.

## SERDP Program

The Second Annual Strategic Environmental Research and Development Program (SERDP) Symposium provides a technology transfer forum for sharing results of research and development projects supported by SERDP. The symposium provides an overview of SERDP activities performed by the three federal partners—the Department of Defense, the Department of Energy, and the Environmental Protection Agency—and their many public and private collaborators.

## Symposium Highlights

This Symposium includes presentations, abstracts, and poster exhibits highlighting SERDP's many innovative technology developments in Cleanup, Compliance, Conservation, Pollution Prevention, Energy Conservation/Renewable Resources, and Global Environmental Change.

## For more information

Erin Cannelli, Registrar

LABAT-ANDERSON INCORPORATED

8000 Westpark Drive, Suite 400

McLean, VA 22102

Phone: (703 ) 506-1400, ext. 512

Fax: (703) 506-0946

Email: [Erin\\_Cannelli@laib.labat.com](mailto:Erin_Cannelli@laib.labat.com)

Yes, I want to receive the brochure for the 2nd Annual SERDP Symposium.

(If you are already on our mailing list and your information has not changed, you will automatically receive a brochure.)

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Please fax this form to Erin Cannelli, Registrar, at (703) 506-0946.

Priority Code SYM96001

## Phytoremediation in SERDP: An Emerging In-situ Cleanup Technology with Exciting Potential (*an update of an earlier success story*)

Phytoremediation is the use of engineered plant or algae ecosystems to clean up contaminated soils, groundwater, or industrial waste streams. In 1992, SERDP began one of the very first phytoremediation research projects to clean up explosives and chlorinated solvents at EPA's National Exposure Research Laboratory in Athens, GA (NERL-Athens).

NERL-Athens discovered four natural reductive processes in sediments. All were traced to stable plant proteins, not microbes. Monoclonal antibodies were derived for a field immunoassay to find the nitroreductase and dehalogenase enzymes (reductive proteins) in plants, sediments, soils, and aquifer materials, making it possible to select and ecologically engineer local plants at a site into wetlands, tree plantations, grass plantings, and other ecosystems that naturally clean up contamination. Rigorous mass balances and pathway analyses prove that TNT and solvents plus all metabolites are completely degraded

and not accumulated; new plant biomass or simple products result. Collaborative batch pilot studies at Alabama AAP by Auburn University and the Air Force's Tyndall Air Force Base showed that the aquatic plant, Eurasian watermilfoil, degraded soil TNT from a sterile 5000 ppm to cleanup standards of 30 ppm. Continuous flow pilots designed by Georgia Tech and Rice University have defined how treatability studies should be conducted for groundwater and soil cleanup of TNT.

In 1994, SERDP's Federal Integrated Biotreatment Research Program Consortium integrated the advances made by NERL-Athens into the overall technology development goals for the Department of Defense. The Consortium is developing treatability protocols for TNT, RDX, HMX, and solvents. Early spinoffs include innovative biochemical plant selection for wetlands at Iowa AAP, treatability studies at the SERDP munitions test demonstration site (Volunteer AAP),

an Environmental Security Technology Certification Program (ESTCP) demonstration to clean up groundwater contamination of municipal drinking water near Milan AAP, and several plant selection and treatability tests at Navy facilities. Rapid progress continues under the Consortium to develop soil treatability protocols and demonstrations while these spinoffs intensify.

This phytoremediation project reflects the strength of science and engineering excellence of EPA, DoD, DOE, and university laboratories, all brought together by SERDP. SERDP support has reduced the phytoremediation demonstration time by at least five years and costs by \$2 million compared to other innovative biotreatments for explosives. For additional information, please contact Dr. Steve McCutcheon at (706) 546-3301 (e-mail: EPASM@Athens.ath.epa.gov), U.S. EPA National Exposure Research Laboratory, Athens, GA.

maintain troops in a constant state of readiness. Military smokes and obscurants constitute a diverse group of chemical agents that are released into the environment during many of these military training exercises (see picture at right). There is concern that these smokes and obscurants may have adverse effects on threatened and endangered species (TES). To address this problem, a group of researchers from the U.S. Army Construction Engineering Research Laboratories and Oak Ridge National Laboratory have not only identified and characterized the smokes, obscurants, and riot control agents released by the U.S. military in training and testing exercises but have also developed a strategy and methodology with which to assess the potential adverse effects of these compounds on TES that reside on U.S.

military training installations. Under SERDP sponsorship, this Army/DOE research team has performed investigations that will help ensure military training realism through the use of statistically sound methodologies (based upon a Gaussian plume smoke dispersion model that operates within GRASS) to evaluate the effects of smokes and obscurants on TES. In addition, researchers have completed a preliminary ecological risk assessment of the effects of military fog oil (No. 2) obscurant on the Red Cockaded Woodpecker (*Picoides borealis*), an endangered species endemic to the southeastern U.S. For more information, contact Dr. Keturah Reinbold at (217) 398-5482, U.S. Army Construction Engineering Research Laboratories, Champaign, IL.



**Military training exercise using obscurants.**

Program Notes

- THE FY96 SERDP IN-PROGRESS REVIEWS (IPRs) will be held in the Washington, D.C. area on the following dates: Conservation—April 30–May 2; Pollution Prevention—May 6–10; Compliance—May 14–16; and Cleanup—May 28–31. All current SERDP projects will be briefed at these reviews except those that briefed at either the February or July SAB meetings. The top-ranking new start proposals will also brief at these IPRs in order to enable the Technology Thrust Area Working Groups to make final recommendations about FY97 new starts. For more information, call Ms. Kimberly Kay at (703) 506-1400 x552.
- PROPOSALS FOR NEW STARTS IN FY97 have been received at the SERDP Program Office. These proposals are currently being reviewed by the SERDP Staff and the appropriate Technology Thrust Area Working Groups (TTAWGs). Top-ranking new start proposals will be briefed at the upcoming In-Progress Reviews (IPRs) in May. Once the TTAWGs make their final recommendations, the new starts will brief the SERDP SAB at either the July or August meeting. For more information, call the appropriate thrust area Program Manager.
- THE SECOND ANNUAL SERDP SYMPOSIUM is scheduled for November 20–22, 1996 at the Sheraton Premier Hotel in McLean, VA (Tyson's Corner area). Please see the enclosed flier for more information, or call Ms. Kimberly Kay at (703) 506-1400 x552.
- NEW SERDP WWW SITE ADDRESS. Although it can still be accessed with the old site reference (temporarily), the new site reference is: <http://www.wes.army.mil/serdp/home.html>. The www site will be moving permanently in the very near future, so change your bookmarks now. Don't forget that the SERDP www site contains an "Announcements" section, which can be used to post important

meeting dates regarding individual SERDP projects or SERDP-related events. For more information, contact Mr. Blake Henke at (703) 506-1400 x546.

- THE NEXT SERDP SCIENTIFIC ADVISORY BOARD MEETING is currently scheduled for mid-July in the Washington, D.C. area. Contact Ms. Kimberly Kay at (703) 506-1400 x552 for more information.
- REMINDER TO PEOPLE WHO WISH TO ATTEND SPECIFIC PRESENTATIONS OF SERDP SAB MEETINGS. Experience has shown that SAB meeting agendas often change during the meeting, so if you plan to attend a particular presentation or segment of the meeting you should call ahead to confirm the time of your particular interest. The person to call is Ms. Kimberly Kay at (703) 506-1400 x552.
- COPIES OF ALL PRODUCTS/REPORTS PARTIALLY OR WHOLLY SUPPORTED BY SERDP should be sent to Blake Henke at the SERDP Support Office in order to keep SERDP staff current on SERDP results and to broaden all aspects of Technology Transfer. These include copies of papers, reports, abstracts, presentations, patents, etc. For more information, contact Mr. Blake Henke at (703) 506-1400 x546.
- E-MAIL ADDRESSES OF PROGRAM OFFICE STAFF HAVE CHANGED. As of April 1, 1996 the e-mail addresses for all SERDP Program Office personnel are:  
Dr. John Harrison = [jarriso@acq.osd.mil](mailto:jarriso@acq.osd.mil); Mr. Gordon Wood = [gogge@acq.osd.mil](mailto:gogge@acq.osd.mil); Mr. Carl Adema = [cadema@acq.osd.mil](mailto:cadema@acq.osd.mil); Dr. Femi Ayorinde = [ayorinf@acq.osd.mil](mailto:ayorinf@acq.osd.mil); Ms. Brenda Batch = [btchbr@acq.osd.mil](mailto:btchbr@acq.osd.mil); Ms. Amy Levine = [amlevine@acq.osd.mil](mailto:amlevine@acq.osd.mil); Ms. Veronica Rice = [ricevse@acq.osd.mil](mailto:ricevse@acq.osd.mil). Please note the change.

SERDP Program Office  
901 N. Stuart St.  
Suite 303  
Arlington, Virginia 22203



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